Building a Fast Boot System—with Intel® Rapid BIOS Boot

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Overview

Are you tired of waiting for your PC to boot? Well, you're not alone. For most computer users, a lengthy boot time is not only frustrating, it also creates a perception of poor system performance. For OEMs, systems with slow boot times generate more tangible problems by creating bottlenecks in the manufacturing process, increasing costs, and reducing productivity.

As a result, the computer industry as a whole is calling for reductions in boot times. Intel is taking a leading role in related industry-wide initiatives and has developed Rapid BIOS Boot (RBB) to enable quicker system boots. This article explains how to take full advantage of RBB and outlines several other key steps for reducing boot times.

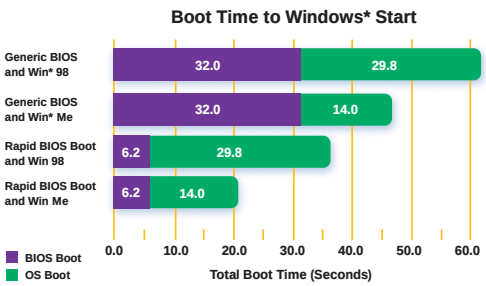

Figure 1: In this test, Intel® Rapid BIOS Boot resulted in an 80 percent reduction in POST time and a 56 percent reduction in the time to Windows Millennium Edition* launch

Three Areas for Improvement

Three major factors affect overall PC boot time—the BIOS boot process, hardware selection and configuration, and choice of OS and software settings. Making well-informed choices in each of these areas significantly reduces boot times.

BIOS Optimization

Typically, a large portion of the boot interval is used by the BIOS (shown in Figure 1) as it initializes I/O devices, performs power-on self test (POST), and scans system buses and main memory.

Intel® Rapid BIOS Boot has streamlined this process, cutting POST time from about 30 seconds to approximately 7 seconds, which reduces overall system boot time by approximately 50 percent. This time reduction was achieved through BIOS code optimization, not trade-offs in functionality.

You can enhance these time savings further with the following BIOS configuration choices. Key steps are highlighted with a §.

§ Enable Intel Rapid BIOS Boot. This important step saves 10 to 12 seconds by eliminating the memory scan and floppy seek, which are typically unnecessary.

- The primary hard drive should be selected as the first boot device in the Boot Order Configuration. If you choose another device, a CD-ROM drive, for example, the boot process will require several extra seconds to determine whether the installed media is bootable.
- If you're not using it, turn it off. As you disable each of the following functions, you save small increments of time, which quickly add up.
  - — Disable USB legacy support on systems not using a USB keyboard or mouse.
  - — Disable unused IDE channels.
  - — Disable the floppy disk controller if there's no floppy drive.
  - — Enable only event logging on systems that require the feature.
  - § Disable LAN when networking is not required—this saves 6 to 8 seconds.
  - — Disable unused I/O ports (parallel and serial).

Hardware Selection and Configuration

Hard drive spin-up, graphic card initialization, and other hardware start-up functions all require precious boot time. Here are some timesaving guidelines for hardware purchase and configuration. Key areas are highlighted with a §.

§ Hard drive selection. Choosing the right hard drive can reduce boot time by 4 to 8 seconds. The key is to select a hard drive with a faster spin-up time — often referred to on datasheets as "power-up to data-ready." In general, look for spin-up times of less than 8 seconds. You may also need to evaluate "power-up to data-ready" times in relation to data transfer rates. For example, 7,200 RPM drives tend to spin up slower than 5,400 RPM drives, but their data transfer rates are better and can therefore load the operating system much faster.

— ATAPI device selection. Avoid devices, such as CD-ROM drives and removable storage drives, that are slow to initialize during POST.

— Add-in Cards. The BIOS cannot control the amount of initialization time used by option ROMs of third-party add-in cards. As a result, you need to consider whether the specific capabilities provided by add-in cards are worth the extra seconds they add to the boot process. Request faster loading option ROMs from your hardware vendors.

§ Video cards may increase boot time by 6 to 8 seconds. So avoid cards with slow-loading option ROMs, such as animated manufacturer logos.

— If your system requires a SCSI controller, avoid cards with slow device detection, and be sure to properly configure your SCSI devices. Use the SCSI controller's BIOS to disable the CD-BOOT if it's not needed.

OS Optimization

Your choice of operating system and applications plays a big role in boot times. Key items are highlighted with a §.

Operating system choices: Microsoft has optimized Windows* Millennium Edition for boot performance. While Windows 98 takes approximately 30 seconds to boot, the Millennium Edition requires only 10 to15 seconds — a reduction of at least 50 percent.

For even better boot times, consider using a Linux* operating system.

§ Optimize further. After you install Windows Millennium Edition, run the "Defrag" program, which contains the Intel® Application Launch Accelerator. This step, in some configurations, may shave an additional 2 to 4 seconds from boot time by optimizing file location on the hard drive.

§ Install the correct drivers. Additional time savings have been observed in conjunction with the installation of Intel® Ultra ATA Storage Drivers. The increased hard drive data transfer rates may reduce OS load times by as much as 14 percent.

§ Other software choices. Watch out for applications that slow down boot time, particularly programs that are loaded into the system tray or start-up folder, or others that load upon OS boot. These programs typically include hot sync managers, program schedulers, sound utilities, and graphics applications. By removing unnecessary applications from the start-up sequence, you can save anywhere from 2 seconds to 20 seconds.

Testing Your Changes

Here's how to test your changes and see what effect they have on boot time.

- Set a benchmark. Begin by measuring your initial boot time, before changing BIOS settings or hardware configurations.
- Measure "power on" to active desktop. Start timing by simultaneously pressing the start button on your stopwatch and the power button on your PC. The moment the hourglass on the desktop turns into a pointer, press the stop button on your stopwatch. This is your total system boot time.

Tests were performed on systems with a 733 MHz Intel® Pentium® III processor, 128 MB of SDRAM, D815EEA Intel Desktop Board with integrated graphics, and Western Digital AA and BA series hard drives operating at 5,400 and 7,200 RPM.

Boot times may vary with system configuration. (Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel® products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance.)

Summary

Improved boot times benefit end users and manufacturers alike.

- For end users faster start-up times improve the perception of PC performance and increase user satisfaction. Today, many users "save up" projects for a single PC session, just to avoid the frustration of long boot times. As boot times decrease, the frequency of PC usage increases.
- For OEMs/Integrators shorter boot times improve manufacturing "beat rates," reduce burn-in time, and enhance overall productivity.

Encourage hardware and software vendors to respond to the computer industry's request for faster boot times. That means communicating your need for faster loading operating systems and application software, as well as faster initializing hard drives, graphics cards, and other devices.

By following the steps outlined in this article, you can reduce frustration for PC users, increase customer satisfaction, and support manufacturing efficiencies.

More Info

The IDU article titled "Zero to OS in 20.2 Seconds," from the August 2000 issue, provides more background information on the Intel Rapid BIOS Boot. It includes test results for optimized systems and provides recommendations for upgrading an older BIOS to Rapid BIOS Boot.

For additional technical details that can help you reduce boot times, visit the PC Design Guides site as well as the Web sites for specific hard drive OEMs and graphics card vendors.

Author Bio

Justin Whitney is a senior product marketing engineer within the Intel Architecture Marketing Group. His project responsibilities have included Intel Rapid BIOS Boot, Intel® Express BIOS Update, and the Superconducting Liquid Cryogenic Level Sensor, for which he holds a patent. Justin holds a B.S. in mechanical engineering from Northwestern University.

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